

CLAIMS

What is claimed is:

- 1 1. An apparatus, comprising:
2 an electrode including a tapered end; and
3 a piezoelectric material of an acoustic resonator disposed over the electrode.
- 1 2. The apparatus of claim 1 wherein the piezoelectric material comprises
2 Aluminum Nitride (AlN), Zinc Oxide (ZnO), or lead titanate zirconate (PZT).
- 1 3. The apparatus of claim 1 wherein the tapered end has an angle between
2 approximately five and thirty degrees.
- 1 4. The apparatus of claim 1 wherein the electrode comprises at least one of
2 aluminum, gold, chromium, platinum, molybdenum.
- 1 5. The apparatus of claim 1, further comprising a top electrode adjacent to a
2 second side of the piezoelectric material, wherein the electrode is a bottom electrode
3 adjacent to a first side of the piezoelectric material.
- 1 6. The apparatus of claim 5, further comprising a substrate layer under the
2 bottom electrode.

1 7. The apparatus of claim 6, further comprising a dielectric layer between the
2 substrate layer and the bottom electrode.

1 8. The apparatus of claim 1 wherein the tapered end is formed through a wet
2 etching process.

1 9. The apparatus of claim 1 wherein the acoustic resonator is a film bulk
2 acoustic resonator (FBAR).

1 10. A film bulk acoustic resonator (FBAR), comprising:
2 a bottom electrode including a tapered end;
3 a piezoelectric layer layered on the bottom electrode; and
4 a top electrode positioned on top of the piezoelectric layer wherein at least a
5 portion of the piezoelectric layer is disposed between the bottom electrode and the
6 top electrode.

1 11. The apparatus of claim 10, further comprising a substrate positioned under
2 the bottom electrode.

1 12. The apparatus of claim 10 wherein the tapered end has an angle between
2 approximately five and thirty degrees between a flat bottom side of the tapered end
3 and a sloped upper side of the tapered end.

- 1 13. The apparatus of claim 10 wherein a first surface area of the bottom
2 electrode is less than a surface area of the piezoelectric layer.
- 1 14. The apparatus of claim 13 wherein at least a portion of a parameter of the
2 bottom electrode includes the tapered end.
- 1 15. A method, comprising:
2 forming a metal layer on top of a dielectric layer; and
3 shaping the metal layer to form a tapered electrode of an acoustic resonator.
- 1 16. The method of claim 15, further comprising placing a photoresist layer on top
2 of the metal layer.
- 1 17. The method of claim 16 wherein shaping the metal layer comprises wet
2 etching the metal layer to form the tapered electrode.
- 1 18. The method of claim 15 wherein the tapered electrode has an angle
2 between approximately five and thirty degrees.
- 1 19. An apparatus, comprising:
2 a piezoelectric layer of an acoustic resonator; and
3 means for preventing cracks in the piezoelectric layer.

1 20. The apparatus of claim 19 wherein the means for preventing cracks
2 comprises a bottom electrode including a tapered end positioned under the
3 piezoelectric layer.

1 21. The apparatus of claim 20 wherein the tapered end has an angle between
2 approximately five and thirty degrees.

1 22. The apparatus of claim 20 wherein the acoustic resonator is a film bulk
2 acoustic resonator (FBAR).

1 23. The apparatus of claim 22 wherein the piezoelectric layer comprises
2 Aluminum Nitride (AlN), Zinc Oxide (ZnO), or lead titanate zirconate (PZT).

1 24. A system, comprising:
2 a film bulk acoustic resonator (FBAR) filter, comprising:
3 a bottom electrode including a tapered end; and
4 a piezoelectric material layered on the bottom electrode; and
5 a transmitter electrically coupled to the FBAR filter.

1 25. The system of claim 24 wherein the piezoelectric material comprises
2 Aluminum Nitride (AlN), Zinc Oxide (ZnO), or lead titanate zirconate (PZT).

1 26. The system of claim 24 wherein the system is a wireless device.